Workshop on Harmonic Analysis and Invariant Distributions

December 14-16, 2009, S14-03-10, NUS

Day 1: December 14, 2009 (Monday)

Morning Session

9:30-10:30

Speaker: Bernhard Krötz (Leibniz Universität Hannover)
Title: Analytic representation theory

Afternoon Session

2:00-3:00

Speaker: Jing-song Huang (Hong Kong University of Science and Technology)
Title: Jaquet Modules and Dirac Cohomology

4:00-5:00 U-Liang Tang (National University of Singapore)
Title: On the discrete spectrum of L^2(N\G; \psi)

Day 2: December 15, 2009 (Tuesday)

Morning Session

9:30-10:30

Speaker: Jian-shu Li (Hong Kong University of Science and Technology)
Title: Some harmonic analysis and special values of L-functions

Afternoon Session

2:00-3:00

Speaker: Avraham Aizenbud (Weizmann Institute of Science)
Title: Relative Representation Theory - from Zero to Positive Characteristic

4:00-5:00 Hung Yean Loke (National University of Singapore)
Title: A notion of spherical representation of the two fold central extension of SL(2, Q_2)

Day 3: December 16, 2009 (Wednesday)

Morning Session

9:30-10:30

Speaker: Binyong Sun (Chinese Academy of Sciences)
Title: Multiplicity preservations of theta correspondences

Afternoon Session

2:00-3:00

Speaker: Hiroyuki Ochiai (Kyushu University)
Title: Invariant hyperfunctions on some semisimple symmetric spaces

4:00-5:00 Chen-Bo Zhu (National University of Singapore)
Title: Existence and non-existence of quasi-invariant distributions

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Abstract of the talks

1. Analytic representation theory
   (Bernhard Krötz)

We define analytic (moderate growth) representations of Lie groups, explain a factorization theorem for analytic vectors in group representations and show that every Harish-Chandra module admits a unique moderate growth analytic globalization (joint with H. Gimperlein, C. Lienau and H. Schlichtkrull).

2. Jaquet Modules and Dirac Cohomology
   (Jing-song Huang)

We show that Dirac cohomology of the Jaquet module of a Harish-Chandra module is a Harish-Chandra module for the corresponding Levi subgroup. We obtain an explicit formula of Dirac cohomology of the Jaquet module for most of the generalized principal series, based on our determination of Dirac cohomology of irreducible generalized Verma modules with regular infinitesimal characters. This is a joint work with Chaoping Dong.

3. On the discrete spectrum of L^2(N\G; \psi)
U-Liang Tang

Let G be a connected quasi-split reductive p–adic group and let N be the unipotent radical of a fixed minimal parabolic subgroup of G. We fix a unitary nondegenerate character, ψ on N and denote $L^2(N\G;\psi)$ the space of all functions on G such that $f(ng)=\psi(n)f(g) $ for $ n\in N$ and $g \in G$ and such that the induced function $|f(\bar{g})|$ on $N\G$ is square integrable. The representation of G on this space is via right translation. Recently, Zhengyu Mao and Erez Lapid has conjectured that if a generic representation of G has a Whittaker model (w.r.t. to ψ) consisting of square integrable Whittaker functions, then the representation itself is in fact in the discrete series of G. In this talk, I will discuss some of the ideas leading to the proof of this conjecture.

4. Some harmonic analysis and special values of L-functions
(Jian-shu Li)

In this talk we will discuss some integrals related to matrix coefficients of unitary representations. These integrals arise in the study of certain explicit values of L-functions.

5. Relative Representation Theory - from Zero to Positive Characteristic
(Avraham Aizenbud)

First, I will present a geometric method, due to Kazhdan, of approximating representation theory of reductive groups over local fields of positive characteristic (like the field F_p((t)) of Laurent power series with coefficients in a finite field) with representation theory of reductive groups over local fields of zero characteristic (like the field Q_p of p-adic numbers).

Then I will present a generalization of this method, due to Gourevitch, Avni and myself, which approximates harmonic analysis over spherical varieties over local fields of positive characteristic with harmonic analysis over spherical varieties over local fields of zero characteristic.

As an application we show that (GL(n+1,F),GL(n,F)) is a strong Gelfand pair for all local fields F of positive characteristic. This means that the restriction to GL(n,F) of every irreducible smooth representation of GL(n+1,F) "decomposes" with multiplicity one. We use our method to deduce this from the zero characteristic case, which was proven two years ago by Gourevitch, Rallis, Schiffmann and myself.

6. A notion of spherical representation of the two fold central extension of SL(2, Q_2)
(Hung Yean Loke)

Let G be the nontrivial two fold extension of SL(2,Q_p). If p is an odd prime number, then the maximal compact subgroup SL(2, Z_p) splits uniquely in G. Let K denote its image. A genuine representation of G is called a spherical representation if the representation contains a K fixed

vector. When p = 2, SL(2, Z_2) does not split in G. In this talk, I will propose a definition for a spherical representation of G. This is a joint work with Gordan Savin.

7. Multiplicity preservations of theta correspondences
   (Binyong Sun)

I will explain, in the nonarchimedean case, a short proof of the multiplicity preservations of theta correspondences for orthogonal-symplectic dual pairs and unitary group dual pairs. This is a joint work with Jian-Shu Li and Ye Tian.

8. Invariant hyperfunctions on some semisimple symmetric spaces
   (Hiroyuki Ochiai)

We consider the special type of semisimple symmetric space SL(n+1)/GL(n), and on such a space, we consider invariant distributions, invariant eigendistributions, invariant hyperfunctions, and the system of (linear) differential equations (=D-modules) defining such (generalized) functions. We give a relation between the double coset decomposition and D-modules. Note that for a regular holonomic system of differential equations, every hyperfunction solution is a distribution, but for non-regular or non-holonomic system, the class of hyperfunction solution may differ from that of distributions.

9. Existence and non-existence of quasi-invariant distributions
   (Chen-Bo Zhu)

In this talk, I will discuss a number of concepts and/or techniques in showing the non-existence of quasi-invariant distributions, introduced in a recent work of Jiang, Sun and Zhu. I will also discuss a previous work (joint with R. Howe) on certain quasi-invariant distributions of pseudo-orthogonal groups which have very special support properties.